

# celduc® relais

## Switching to the Future: SDI Solid-State Relays for Rail



**D**esigned for high-demand rail applications, celduc® relais' SDI range of solid-state relays offers enhanced performance, reduced maintenance and real-time monitoring to keep rail systems running smoothly.

Safely and reliably switching high-voltage DC power has long been a challenge for the rail sector, given the demands of its electrical systems. DC networks often lack natural current zero-crossings, making arc extinction difficult during switching events. Additionally, many rail applications involve long distribution lines, such as catenary systems, which introduce significant line inductance. This greatly increases the energy that must be safely dissipated during switching.

Traditionally the sector has used electro-mechanical

relays (EMRs), but they've proven slow in responding to faults, require external protection circuits and suffer thermal management issues, leading to risks from overvoltage and short-circuits. They're also considered prone to wear: needing regular inspection or replacement due to mechanical fatigue.

In response to these issues, experts at celduc® relais have developed the SDI range of solid-state relays (SSRs), engineered to better handle the demanding conditions of railway networks.

SSRs offer many advantages over their EMR counterparts. Their lack of moving mechanical parts means they're not subject to wear and tear or deformation, and they're capable of reliably switching a wide variety of loads found in rail systems, including resistive elements, motors, power converters and lighting systems.



and overcurrents, compatibility with low switching frequencies and lower conduction losses at high currents.

Built in with advanced protections including active clamp circuits and real-time monitoring and fault detection, the SDI range provides a safe, efficient and maintenance-free alternative to traditional relay offerings. Its 750VDC rating is a key advantage, as this is a common voltage level in urban transit networks such as metro systems and trams, however it delivers a higher voltage capability of up to 940VDC.

## Smarter Switching for Modern Rail

As onboard electrical systems become more sophisticated and expectations for reliability, efficiency and proactive maintenance go up, the SDI range offers a clear upgrade path from electromechanical switching devices. Each unit is equipped with diagnostic and status outputs that provide real-time information about the relay and installation, enabling operators to detect and address issues quickly. For example, if a power supply fault occurs – such as a blown fuse, open load or excessive leakage current – the relay will signal it immediately, reducing downtime, simplifying maintenance and preventing more serious and costly failures.

The 50A model also features continuous current monitoring, allowing early detection of abnormal load behaviour by preventing overloads and driving the system to remain within safe operating limits. Together, these capabilities support predictive maintenance, improve safety and help keep rolling stock running reliably with minimal disruption.

## IGBT Technology

celduc® relais' SDI range leverages insulated gate bipolar transistor (IGBT) technology, combining the high input impedance and fast switching of metal-oxide-semiconductor field-effect transistors (MOSFETs) with the high current and voltage-handling capabilities of bipolar junction transistors (BJT)s.

Unlike pure MOSFETs or thyristors, IGBT's are better suited to high-voltage DC applications due to their higher voltage ratings, resistance to overvoltages

## Key Features and Benefits

Designed for high-demand DC applications, the SDI range of solid-state relays (SSRs) combines performance, reliability and easy integration:



- **High DC capacity** – switches up to 100A at 750VDC nominal (up to 940VDC)



- **IGBT technology** – fast switching with high current/voltage handling for demanding DC loads



- **Long operational life** – mean time to failure (MTTF) up to 118 years; no moving parts to wear out



- **Intelligent monitoring** – real-time diagnostics and optional continuous current monitoring



- **Flexible integration** – multiple control voltages (24–110VDC) and load connection options



- **Railway-grade design** – rugged construction certified to EN 50155 and EN 45545-2

## Critical Compliance

Additionally, the range's compact, rugged design has been designed to meet railway standards EN 50155 and EN 45545-3. These certifications can only be obtained after a series of rigorous tests designed to simulate extreme conditions in a railway environment, including voltage variations, power interruptions, supply changeover, vibration and temperature extremes and fire conditions, making them safe and dependable for use across a wide variety of railway systems.

## Built to Last

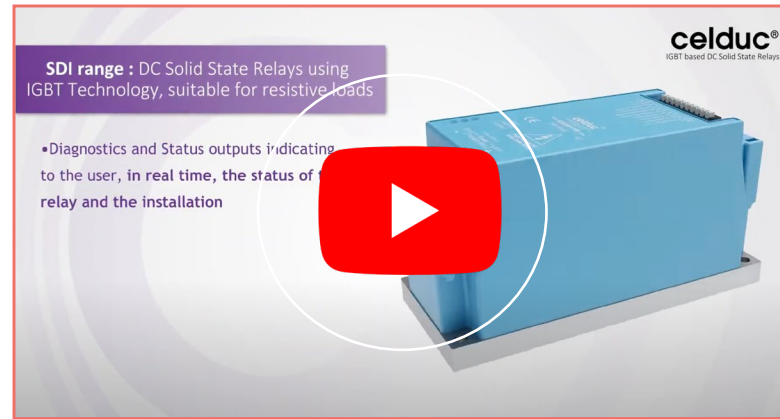
Another benefit of the SDI range is high life expectancy. According to calculations based on ISO13849-1, the mean time to failure (MTTF) is 118 years, with a diagnostic-based MTFF of 236 years. Even in extreme conditions, the relays are expected to last over 20 years, far beyond what traditional solutions typically offer.

This commitment to performance and reliability has made celduc® relais the supplier of choice for major rail operators across Europe, including the integration of SDI SSRs into a new tramway project with Poland's largest rolling stock manufacturer.

## Safety First

The SDI range delivers safety through advanced protection features and robust construction:

- **Inductive spike protection** – active clamp technology prevents equipment damage
- **Built-in safeguards** – overvoltage, overcurrent and overtemperature protection as standard
- **Fault lock-out** – automatic shutdown after four short-circuit events for inspection
- **Operator safety** – fully sealed solid-state design eliminates arcing and exposed contacts
- **Certified safety** – meets EN 50155 and EN 45545-2 standards for fire safety, shock, vibration and EMC compliance



## Developing the Next Generation of Rail Relays

As electric trains and rail electrification continue to expand globally, celduc® relais sees solid-state playing an increasingly central role in modern rolling stock and infrastructure. The technology's key advantages, such as long service life, maintenance-free operation and built-in diagnostics, make it particularly well-suited for the demanding and safety critical environment of rail transport.

With this in mind, its R&D team is continuing development in this area, working on a more compact version of the SDI solution. Size is a critical factor in onboard systems, as space is often limited, with every piece of equipment needing to be as compact as possible without compromising performance or reliability. Furthermore, reducing footprint offers additional benefits including improved energy efficiency and higher power density, driving an easier integration into existing and new designs.

celduc® relais is also currently in the midst of developing a modular DC relay designed to cover a large voltage range. This approach will allow greater flexibility and scalability, enabling the SSR to be easily adapted to different applications and voltage levels.

Learn more about celduc® relais' SDI range of SSRs in the video overview above.

To find out more visit our [website](#) or [contact one of the team](#)

